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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/766,465

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Ling Ma

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EXAMINER

KIM, SU C

ART UNIT

PAPER NUMBER

2823

MAIL DATE

DELIVERY MODE

11/24/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/766,465	Applicant(s) MA ET AL.	
	Examiner SU C. KIM	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 August 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-6 and 8-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4-6 and 8-11 is/are rejected.
- 7) ☒ Claim(s) 12 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 8/25/2008 have been fully considered but they are not persuasive.

With respect to claims rejection under 35 U.S.C. 102(b), applicant argues that “the sidewall of the termination trench to be adjacent the channel region and the bottom of the termination to be adjacent a region of a conductivity type opposite the conductivity type of the channel region (i.e. a region of first conductivity type).”

In response to applicant's contention, it is respectfully submitted that **JP2000-101074 (hereafter, “Hirohiko)** discloses all the claimed limitation including “the sidewall of the termination trench to be adjacent the channel region and the bottom of the termination to be adjacent a region of a conductivity type opposite the conductivity type of the channel region (i.e. a region of first conductivity type).”below.

Hirohiko appears to show, see Fig. 4, the sidewall of the termination trench 76 (a side of a trench 76) to be adjacent the channel region 29 or 34 (paragraph 0015 & 0016, elements 29 & 39 are n type) and the bottom of the termination 76 (a bottom of the element 76) to be adjacent a region of a conductivity type 28 (note: part A is P type conductivity) opposite the conductivity type of the channel region (note: element 29 & 34 are n-type) (i.e. a region of first conductivity type).

Therefore, the rejection of claims 1 & 7-9 under 35 U.S.C. 102(b) are deemed proper.

In addition, for the rejection of claims 4-6 & 10, the *prima facie* case of obviousness has been met and the rejection under 35 U.S.C. § 103 is deemed proper.

Claim Objections

2. Claim 1 is objected to because of the following informalities: in claim 1 (line 21-22), reciting “a bottom adjacent said - -” is not clear, perhaps, changes to “a bottom of said termination trench adjacent said- -”. Appropriate correction is required.

Claim Rejections - 35 USC § 102

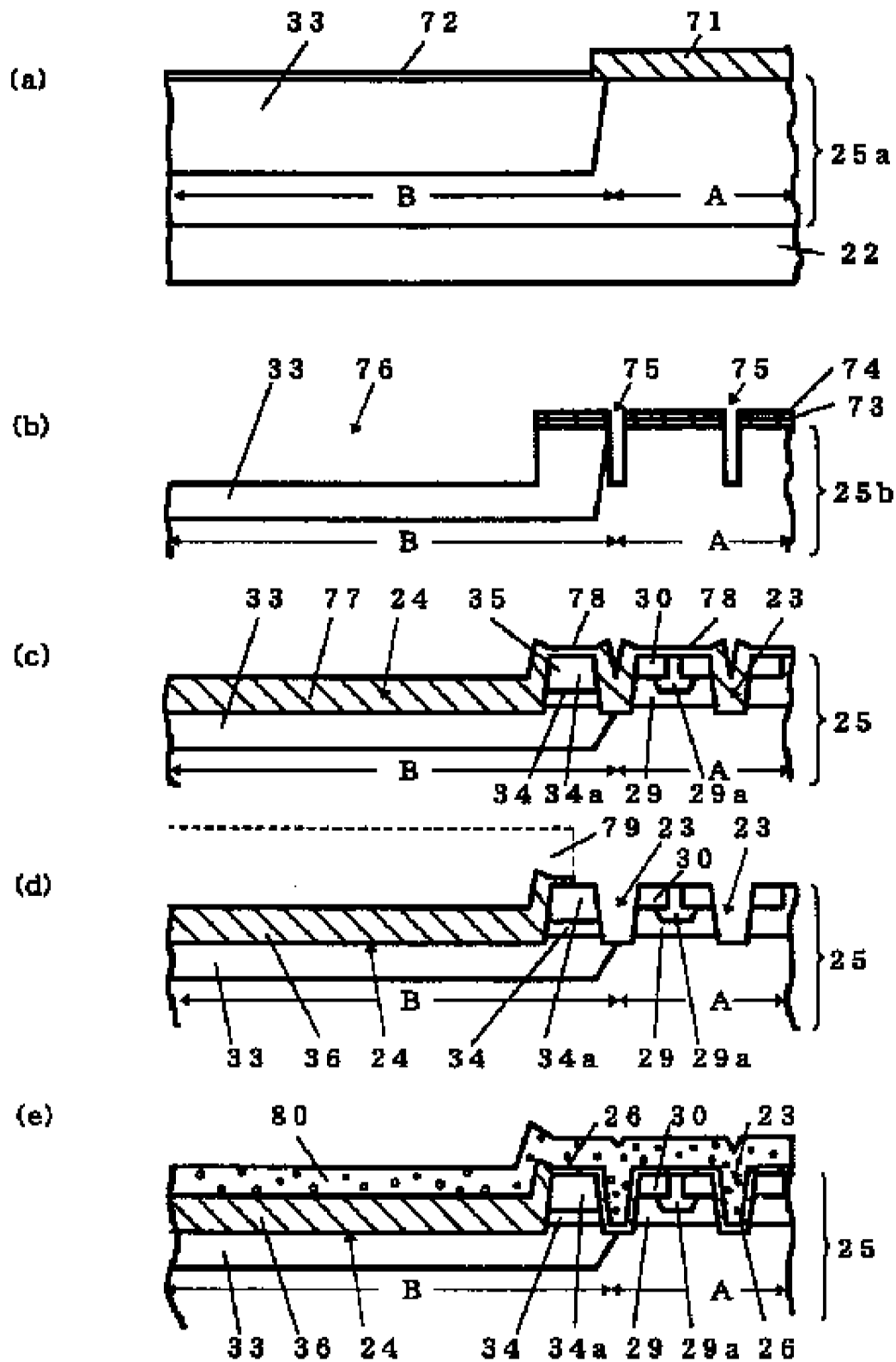
3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 8-9, & 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Hirohiko (JP2000-101074).

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Regarding claim 1, Hirohiko discloses a DC-DC converter comprising:

a synchronous semiconductor device; and

a control semiconductor device (Uno discloses a power mosfet);

wherein a least one of said semiconductor devices includes:

a semiconductor body of a first conductivity 25 (note: P type) which includes a channel region 29 or 34 of a second conductivity (note: N type) and a major surface (Drawing 4);

an active region 29 formed in said semiconductor body 29 , said active region including a plurality of spaced trenches each less than 0.5 microns wide (paragraph 0020, note: 0.2-0.7 micrometer) through said channel region 29 (Drawing 4);

a gate structure 27 disposed in each said trench, each gate structure including a gate oxide 26 layer disposed at least on sidewalls of a trench and a gate electrode 27 disposed adjacent said gate oxide 26 (Drawing 5);

conductive region 30 of said first conductivity formed in said channel region adjacent each said trench (Drawing 5);

highly doped contact regions 29a of said second conductivity formed in said channel region 29 (Drawing 5) each being laterally confined between two opposing conductive regions 30 & 29a (Drawing 5);

a metallic contact 32 (paragraph 0015, note: ohmic contact) in contact with said conductive regions 32 and said highly doped contact regions 29a; and

a termination structure, said termination structure including,

a termination trench 24 (Drawing 4) formed in said semiconductor body, said termination trench including a slanted sidewall adjacent said channel region 29 or 34 (Drawing 4) and a bottom adjacent said semiconductor body 25; a grown field oxide 36 formed in said termination trench below said major surface; a polysilicon field plate 37 formed over said field oxide 36 (Drawing 4); and an oxide body 31 over said polysilicon filed plate 37, wherein said filed oxide layer 36 is thicker than said gate oxide layer 23, wherein said metallic contact 38 extends over said oxide body 31, and wherein said semiconductor body 34 of said first conductivity (note: n type) extends from said active region to the bottom of said termination trench 28 (Drawing 4), whereby said bottom of said termination trench is adjacent a region of said first conductivity type 34 (Drawing 4, note: a term adjacent is interpreted as "close to").

Regarding claim 8-9, as applied to claim 1, Hirohiko discloses that each said trench is stripe or cell (Hirohiko Drawing 3).

Regarding claim 11, as applied to claim 1, Hirohiko discloses that said trenches 75 (Drawing 5(b)) extend to a first depth into said semiconductor body, and said termination trench extends to a second depth into said semiconductor body 76 (Drawing 5(b)).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirohiko (JP2000-101074) in view of Thapar (US 2001/0026989).

Regarding claim 4, as applied to claim 1, Hirohiko discloses each said trench includes an oxide mass formed at its bottom, said oxide mass and said gate oxide 23(Drawing 4).

Hirohiko fails to teach said oxide mass is thicker than said gate oxide.

However, Thapar disclose that said oxide mass 61 is thicker than said gate oxide 20 (Fig. 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Hirohiko with said oxide mass is thicker than said gate oxide as taught by Thapar in order to improve a low gate to drain capacitance (paragraph 0003).

Regarding claim 5, as applied to claim 4, Hirohiko and Thapar in combinations disclose that a semiconductor substrate 22 of said first conductivity, said semiconductor body 28 being formed over said semiconductor substrate 22, wherein said conductive regions are electrically connectable to said semiconductor substrate through invertible channels adjacent said trenches (Hirohiko, Drawing 4).

Regarding claim 6, as applied to claim 5, Hirohiko and Thapar in combinations disclose that said conductive regions are source regions 30 (Hirohiko, Drawing 4).

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirohiko (JP2000-101074) in view of Williams et al. (US 2002/0019099).

Regarding claim 10, as applied to claim 9, Unod disclose said trench is a cell (Drawing 3).

Uno fails to teach said cell is hexagonal.

However, William discloses a cell is hexagonal (Fig. 4D).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Uno with a cell is hexagonal as taught by William in order to reduce channel resistance.

Allowable Subject Matter

8. Claim 12 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to SU C. KIM whose telephone number is (571)272-5972. The examiner can normally be reached on Monday - Friday, 10:00AM to 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Primary Examiner, Art Unit 2823

/Su C Kim/
Examiner, Art Unit 2823